2 Controlling Invasive Species

"We are living in a period … when the mingling of thousands of kinds of organisms from different parts of the world is setting up terrific dislocations in nature."

—Charles Elton, 1958

The economic and ecologic impact of invasive (exotic) species—plants, animals, and microbes that have not evolved in concert with an area's native species—is a global problem. By some estimates, these species, which include tamarisk, Asiatic bittersweet, kudzu, West Nile virus, feral pigs and goats, hemlock woolly adelgid, zebra mussels, and Africanized bees, cost the U.S. economy $138 billion annually. In the case of national parks, exotic species are recognized as one of the most serious threats to the integrity of park natural systems, including rare native plants and animals, and are implicated in the decline of approximately 40% of the species listed as threatened and endangered under the Endangered Species Act. Today, exotic plants infest some 2.6 million acres (1.1 million ha) of national park lands, while 234 parks contain invasive animal species in need of management. Controlling exotic species is an urgent priority for the National Park Service, and the articles in this chapter describe some of the ways parks across the nation responded to this challenge in 2004, particularly invasive plants. These articles show that NPS Exotic Plant Management Teams and the creation of extensive partnerships among federal and state agencies, universities, and local citizen groups have emerged as hallmarks of successful control efforts. Protecting the parks from harmful exotic species is a daunting challenge, but certainly an essential part of sustaining our natural heritage and meeting the mission of the National Park Service.

Disposable pets, unwanted giants: Pythons in Everglades National Park

By Ray W. "Skip" Snow and Lori Oberhofer

HUGH WILLOUGHBY, A GENTLEMAN EXPLORER of the late 1890s, referred to the mainland along the southern coast of Everglades National Park as the "Land of the Big Snake." Willoughby, in his telling of an 1896 canoe journey across the Everglades, noted two different Indian accounts "of snakes that were at least 18 feet in length, and evidently belonged to the constrictor family."

Reports of "big snakes" in Everglades National Park a century later include regular and increasing sightings of Burmese pythons and occasional, infrequent sightings of ball pythons, reticulated pythons, and common boas. Unretouched photographs depicting alligator vs. python appeared in the 25 February 2003 issue of the *National Examiner* under the headline banner, "Mighty beasts grapple for *24 hours* as shocked Florida tourists watch!" (The alligator eventually released the snake, although whether it survived or not is unknown.) Remarkably, in February 2004, this event was repeated at a different location in the park. Unlike the rare and infrequent circus animal escapees during Willoughby's time, pythons in the wild today are the result of unwanted and intentionally released exotic pets.

As Burmese pythons are known to eat birds, the proximity of python sightings to the Paurotis Pond wood stork rookery is troubling.

The Burmese python (*Python molurus bivittatus*) can reach a length greater than 20 feet, making it a big snake indeed. The nonnative python's diet in the Everglades includes gray squirrel, opossum, cotton rat, black rat, house wren, pied-billed grebe, and white ibis. Raccoons and other small mammals such as the native mangrove fox squirrel, a species of special concern, could also provide a suitable food base for pythons in the park. As Burmese pythons are known to eat birds, the proximity of python sightings to the Paurotis Pond wood stork rookery is troubling.

Observations of pythons have occurred primarily in three locations in the park: the saline glades and mangroves between Flamingo and Paurotis Pond, the greater Long Pine Key area, and the greater Shark Valley area along the Tamiami Trail. Pythons have also been observed on the eastern park boundary, along canal levees, in the remote mangrove backcountry, and in Big Cypress National Preserve to the northwest. Since December 2003, more than 50 Burmese pythons have been captured and removed or found dead on roads in and adjacent to the park. Individuals 10–12 feet (3.0–3.7 m) in length have been seen with increasing regularity in the park.

In recent years, multiple observations of individuals of different size classes support the probable establishment of breeding populations of the Burmese python in Everglades National Park. Snakes recovered ranged in length from 2 to 14 feet, including five hatchling-sized animals recovered in the summer of 2004.

Burmese pythons are widely bred in Florida and are still imported from Southeast Asia as pets. Proposed management actions must include strategies for preventing their intentional release. Actions currently undertaken by the park's wildlife unit include: (1) preparing and distributing an "exotic snake alert" flyer and prevention materials based on a "Don't Let It Loose" media campaign to encourage responsible ownership and proper disposal of unwanted exotic pets; (2) summarizing information on all observations and specimens of pythons from the park; (3) researching available information on life history, behavior, home range, and food habits, as observed in their native habitat; and (4) investigating methods of capture, restraint, and disposal, including the use of snake-detecting dogs. The park is also participating on the Florida Invasive Animal Task Team, an interagency effort to stem the tide of nonnative animals. ■

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The intentional release of unwanted exotic Burmese pythons into the wild over the last 20 years is responsible for an increasing population of breeding pythons in Everglades National Park today.

The Burmese python can reach lengths greater than 20 feet (6.1 m). Their diet includes birds and mammals. The national park is concerned that the wood stork, a federally listed endangered species, and mangrove fox squirrel, a state-listed threatened species, could be consumed.

Partnering for plant control at Arches National Park

By Linda Drees

SEVENTY WEED WARRIORS FROM NATIONAL PARKS around the United States descended on Arches National Park, Utah, 9–14 March 2004, to take action against invasive plants and accumulated fire fuels that threaten natural resources. Deputy Superintendent Phil Brueck notes that "the Tamarisk invasion in western parks is affecting many of the very resources for which the parks were originally set aside. [Views] are being obscured, portions of streams and rivers are becoming inaccessible to hikers and boaters, and some flora and fauna, including endangered species, are being threatened from this exotic encroachment." To combat the problem, 14 Exotic Plant Management Teams (EPMTs) worked to rid Courthouse Wash of tamarisk (salt cedar, *Tamarix ramosissima*) and Russian olive (*Elaeagnus angustifolia*).

Exotic Plant Management Teams are modeled after wildland fire-fighting strike teams and consist of highly trained plant management specialists who assist parks in controlling exotic plant species. Sixteen teams have been established across the National Park System, each serving national parks in a distinct geographic area.

Given the magnitude of the project and the participation of numerous crews from across the country, Arches initiated the National Park Service's use of the incident command system for an invasive plant management deployment. Before the first teams arrived, staff from the park, Lake Mead EPMT, and other experts developed an incident action plan to organize the project. The plan included a series of objectives for maintaining a safe work environment, controlling tamarisk and Russian olive, chain saw operation training, and international outreach. The teams met or exceeded all objectives.

The National Park Service's recent success in controlling invasive plants has created strong interest in the strike team model of the EPMTs. The deployment at Arches provided an opportunity for

(Above) Exotic plant management specialists strike out toward beleaguered Courthouse Wash, an area in Arches National Park infested with invasive tamarisk and Russian olive. The weeklong deployment in March 2004 was the first to bring together several Exotic Plant Management Teams and NPS partners for a joint training and work exercise, and succeeded in controlling more than 100 acres (41 ha) of the targeted invasive plant species (right).

information sharing with resource managers from other countries, federal and local agencies, and academia. Miguel Mendoza, operations coordinator for Santa Elena Canyon Flora and Fauna Protected Areas of the National Commission of National Protected Areas of Mexico, worked with the teams all week to exchange best management practices for controlling tamarisk. Jeff King, with the U.S. Fish and Wildlife Service Region 6, viewed the teams' operation in anticipation of interagency inventory and control efforts in Arizona and Montana. Dr. Steve Dewey, the first academician to suggest applying the fire model to invasive plant control, spent several days witnessing the teams' use of the model in the field as he had envisioned. Dr. Ron Hiebert and several graduate students of the Colorado Plateau Cooperative Ecosystem Studies Unit field-tested the new restoration ranking tool to help park managers make decisions on restoration priorities. Montana State University students filmed the entire event, and the film will be available for public viewing next year.

The National Park Service is the first land management agency to apply the fire model to fight invasive plants. This innovative approach, initially used at Lake Mead National Recreation Area (Nevada and Arizona), led to the establishment of 16 teams of specialists in invasive plant identification and control. At Arches National Park, the project approach proved a rousing success. Natural recovery of willows and cottonwoods is expected. The teams doubled the size of the planned treatment, resulting in the removal of tamarisk and Russian olive from 108 acres (44 ha) in just seven days. As one team member stated, "this is extreme weed work." Regardless of weather, scope of the problem, species, and location, EPMT members remain undaunted in their daily commitment to stopping invasive weeds to preserve our natural heritage. ■

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NPS**FACT**
Since 2003 the NPS Exotic Plant Management Teams have attracted and spent more than $4 million and directed the equivalent of **more than two years of work by volunteers** to begin controlling the more than 2.6 million acres (1.1 million ha) in the National Park System that are infested with invasive plant species.

Can we beat the weeds? An exotic plant project at Catoctin Mountain Park

By James W. Voigt

Park Ranger Becky Loncosky surveys exotic plants at Catoctin Mountain Park and is surrounded by mile-a-minute (*Polygonum perfoliatum*), an invasive species on the park's top-15 list of control priorities. Though its distribution in the park is more limited than Japanese barberry (*Berberis thunbergii*), another high-priority plant, mile-a-minute dominates sites where it takes hold.

Exotic plant control can be like putting out fires; you deal with the hottest problem at the time. The resource management staff at Catoctin Mountain Park (Maryland) has battled exotic plants for 10 years. Some control efforts appear to be working, but several species continue to expand. Until this year, the park has lacked an understanding of the extent of this problem and an effective strategy for dealing with it.

In 2003–2004 the park conducted an exotic plant evaluation project, funded by a Natural Resource Preservation Program block grant. After compiling the existing records for previous survey and control work, park staff conducted a comprehensive survey to identify the 15 most invasive species. The survey covered 22 miles (35 km) of the park boundary, 8.5 miles (13.7 km) of roads, and 22 miles (35 km) of the park monitoring grid. They used GPS to record the presence and relative density of the targeted species within 33 feet (10 m) of each survey transect and then created a map for each species using GIS.

Studying the mapped data, investigators discovered that the exotic plant invasion at Catoctin Mountain Park is more intense and widespread than previously thought. The control strategy will focus on wetland and riparian areas, where most of the threatened and endangered species are located, in addition to two cultural landscapes. Park staff and the Youth Conservation Corps will deal with small areas and annual maintenance. The regional Exotic Plant Management Team will treat the high-density infestations. Getting rid of all the aliens is practically impossible, but the park's goal, with a concerted effort, is to ensure visitors are never unable to see the forest for the weeds. ■

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Park celebrates the removal of last tamarisk

By Fran Pannebaker and Karl Zimmermann

AFTER 10 YEARS OF HARD WORK, the National Park Service and volunteers have completely eliminated all standing tamarisk (*Tamarix ramosissima*) from Bent's Old Fort National Historic Site in southeastern Colorado. On 4 June 2004, they celebrated this feat by ceremoniously cutting the last remaining tamarisk, which symbolized more than 350 acres (142 ha) of tamarisk being removed from the 800-acre (324-ha) national historic site.

By the late 1980s, tamarisk was visibly outcompeting the park's native riparian vegetation and negatively impacting the historical scene. Moreover, the plant's thick growth habit created a fire hazard for the cottonwood-willow plant community. When resource managers at Bent's Old Fort began assessing the extent of the infestation, they contracted the Colorado Natural Heritage Program to prepare a vegetation map of the historic site using infrared aerial photography and GIS technology. The park subsequently developed a management plan, which laid out goals, priorities, and strategies. They received funding from the Small Park Block Grants of the Natural Resource Preservation Program, Exotic Plant Management Teams (EPMTs) of the Natural Resource Challenge, and the Department of the Interior's Cooperative Conservation Initiative.

Resource Manager Karl Zimmermann cuts the last standing tamarisk at Bent's Old Fort National Historic Site, Colorado, in June 2004. Ten years in the works, the project involved many partners: the Chihuahuan Desert–Southern Shortgrass Prairie EPMT and EPMTs from Lake Meredith and Lake Mead National Recreation Areas, neighboring ranchers, the Colorado Department of Corrections, Comanche National Grasslands, the Natural Resources Conservation Service, the Colorado State Forest Service, and the Colorado Division of Wildlife. In addition, the Alpine Interagency Hotshot crew based at Rocky Mountain National Park; the fire suppression and fuels management personnel, also from Rocky; staff from Florissant Fossil Beds National Monument; Intermountain Region fire staffs; employees from the USDA Forest Service; and several local fire departments contributed to the effort.

Controlling tamarisk required cutting the trees to within 6 inches (15 cm) of the ground and applying herbicide to the stumps. Most of the work was done using chain saws and herbicide in backpack sprayers. Some of the trees were cut with a Bobcat-mounted tree shear; however, in order to minimize impacts to the Arkansas River floodplain, which bisects the park, this was the largest equipment used. After sawing, the limbs were piled and the slash was burned. Because of the small number of park employees, many partners were needed for this operation. Restoration and partnership development greatly contributed to the project's success.

When park neighbors saw the changes in the riparian plant community … they began to ask questions and take action on their own land.

In 2000 the Chihuahuan Desert–Southern Shortgrass Prairie EPMT was formed. The team began to assist the park in 2001 and continues to help control tamarisk resprouting, as well as infestations of other invasive species: whitetop (*Cardaria draba*), Canada thistle (*Cirsium arvense*), and Russian knapweed (*Acroptilon repens*). Monitoring and follow-up control efforts have been incorporated into the park's routine exotic plant management program. The park has been able to maintain control of tamarisk regrowth despite two major floods and a major wildfire. Monitoring has indicated 90% control after the first treatment.

Currently the park is working with its neighbors and other agencies to encourage the organization of additional tamarisk control projects on other stretches of the Arkansas River. When park neighbors saw the changes in the riparian plant community at Bent's Old Fort and realized the value of those changes for their own properties, they began to ask questions and take action on their own land. The Colorado Forest Service and Division of Wildlife are working together on state-owned land along the Arkansas River in the vicinity of the national historic site. Efforts to organize control projects are proceeding on the main stem of the Arkansas River and on several of the major tributaries. The Nature Conservancy, Tamarisk Coalition,

USDA Forest Service, Department of Defense, Natural Resources Conservation Service, U.S. Army Corps of Engineers, and the State of Colorado are all working to control tamarisk in the watershed.

Nationally the efforts at Bent's Old Fort National Historic Site represent a growing trend toward managing invasive species, especially tamarisk, which is found from Pacific Coast states to the Midwest and from Canada to Mexico. Because of this wide distribution, land managers at different levels of government are now forming partnerships to enhance program effectiveness for tamarisk control in western watersheds. ■

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Removal of mouflon sheep from Amistad National Recreation Area

By Rick Slade

In 2004, Amistad National Recreation Area (Texas) began to remove more than 2,000 nonnative mouflon sheep (*Ovis musimon*) from a large tract of the park designated for recreational hunting of whitetail deer (*Odocoileus virginianus*) and other native species. In cooperation with neighboring landowners and a group of wild-game trappers, park staff began the livetrapping operation in May 2004 and had successfully removed more than 1,300 sheep by the end of June, when increasing summer temperatures brought activities to a temporary halt. The benefits of this effort are already evident in the rejuvenation of the shrubs, forbs, and grasses that provide shelter and nutrition to a variety of native wildlife.

Mouflon sheep were first documented in the park in the mid-1970s when a single breeding pair entered the park from a neighboring ranch. The population steadily increased over the next 20 years, reaching more than 400 individuals by the mid-1990s. In recent years, population growth accelerated, creating a number of critical resource management issues. Because mouflon travel in large herds (photo), their grazing and browsing effects are concentrated and particularly stressful to the area's thin soils and limited vegetation. In documenting the impacts of the sheep, the park's resource management staff determined that the sheep were outcompeting whitetail deer for food, leading to a gradual reduction in the area's deer population.

Public consultation, including a well-attended public meeting to explore management alternatives, was an important part of the process. There was unanimous agreement that the sheep should be removed to protect park resources, and that livetrapping of the animals was the preferred option. Park staff engaged adjacent landowners and residents of a nearby housing development as partners, which has proved critical to the operation's success. Access to adjacent properties has allowed the trappers to pursue all of the sheep, not just those found within park boundaries.

The trapping has been accomplished using net guns fired from a helicopter (photo), which has minimized landscape impacts but increased noise in the area. Without the full support and understanding of nearby residents, conflicts over noise would have been inevitable. After trapping, the sheep are transferred to a private ranch near San Antonio where most are sold to out-of-state ranches to ensure they do not return to the park. Park personnel monitor the area for sign of the sheep's recurrence. As work resumed in the fall, all parties remained united in the goal of eradicating the sheep and allowing the recovery of a natural landscape. ■

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Native plant restoration designed to avoid wildlife-traffic conflicts

By Kathy Penrod

Asiatic bittersweet (*Celastrus orbiculatus*) has invaded an old highway corridor through a developed area of the Allegheny Portage Railroad National Historic Site (Pennsylvania). With funds from the National Park Service's Cooperative Conservation Initiative and the help of volunteers (from Senior Rangers to Girl Scouts), the bittersweet and other exotics are being removed and the area restored with native grasses and wildflowers.

The plants had grown wild from former home sites within the park, running rampant and forming dense thickets wherever they found full sun. The threat to natural resources in the park was clear: the bittersweet was overtopping and killing trees.

The bittersweet was sprayed with herbicide in early June 2004, killing 60% of it. A second spraying was completed in September. Meanwhile, 228 volunteers pulled out other exotics over five project days. Literally thousands of garlic mustard (*Alliaria petiolata*) and teasel plants (*Dipsacus sylvestris*) were removed in 2003 and 2004 to prevent their seed from invading the restoration site. In spring 2005 the site will be planted with native grasses and wildflowers.

Asiatic bittersweet overtopped trees along the highway corridor through the park (above). Herbicide treatment in June 2004 reduced the infestation by about 60%.

Though it is improving native habitat for birds, the restoration is designed so that it does not attract deer and other large mammals because of vehicular traffic that is directly adjacent to the site. Rather than switchgrass (*Panicum virgatum*) and Indian grass (*Sorghastrum nutans*), which would provide tall cover for animals, short grasses such as little bluestem (*Andropogon scoparius*), purple top (*Tridens flavus*), deer tongue (*Panicum clandestinum*), and broomsedge (*Andropogon virginicus*) are being used. Wildflower species that are not too tall were also chosen, including Pennsylvania ecotypes of asters, beardtongues (*Penstemon*), goldenrods (*Solidago*), and sunflowers (*Helianthus*). ■

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Manual control of the problem plant can be accomplished by park staff or volunteers. The best results are achieved by grabbing individual stems with both hands close to the soil surface and pulling straight up.

Manual control of Canada thistle: A reasonable alternative for controlling small infestations in sensitive areas

By Marie M. Curtin

PARK STAFF AT WIND CAVE NATIONAL PARK (South Dakota) achieves good results controlling Canada thistle (*Cirsium arvense*) using a simple, old-fashioned method: weed pulling. Manual control was selected over other management alternatives in order to protect diverse native plant communities and the watershed that houses dozens of the park's cave and karst features, including Wind Cave, an extensive maze of more than 112 miles (180 km) of subsurface passages. Manual control is one component of the park's Integrated Pest Management Program, which seeks to control Canada thistle using methods that do not conflict with management goals for the park's natural resources.

Canada thistle, native to Eurasia, arrived in this country during the 1800s. Most of the diseases and parasitic insects that harm Canada thistle are absent from North America. As a result, the invasive plant competes aggressively with native vegetation and can reduce native plant species extent and diversity, and habitat available for wildlife.

The environmental advantages of manual control are also compelling. Weed pulling introduces no exotic biological control agents (insects or pathogens) into the ecosystem.

Pulling Canada thistle by hand is hard work, but well worth the effort because it preserves native plants that might be harmed by chemicals or other control methods. Weed pulling also protects sensitive cave resources, another key management priority. Chemicals most effective against Canada thistle are capable of easy movement through soil and root systems and into groundwater and caves. Cave ecosystems are relatively closed systems that do not recover quickly from changes to their environments. Chemicals applied within the watershed have the potential to leach into Wind Cave, which could impact cave flora and fauna and water resources used for human consumption.

Many infestations of Canada thistle consist of only one plant, but it is a plant with an extensive root system that acts as the support structure for many aboveground stems, flowers, and seed heads. The goal of weed pulling is to starve the root system. When the entire plant is pulled, removing as much root as possible, the plant draws from root reserves to create new stems and leaves capable of conducting photosynthesis. Repeat pulling exhausts the root system, basically starving the plant to death.

The most intensive weed pulling efforts are directed against infestations occurring in riparian areas, drainages, and otherwise pristine areas throughout the park. To reduce potential for seed dispersal by humans, sites along roads and trails are also a priority. Remaining infestations are kept in check with biological and mechanical control methods. These sites are eventually designated for manual control, replacing sites that no longer require treatment. Park personnel monitor treated sites annually for plants that regrow and new plants that germinate from seed.

During the 2004 field season, dozens of small infestations in sensitive areas were pulled or repulled by park staff. At some locations this was a continuation of weed-pulling efforts initiated in previous years. Each return visit required less time and energy. The sites experienced dramatic reductions in overall size, stem density, or both. At several locations, Canada thistle could not be located upon return visits.

Exotic vegetation poses a significant threat to diverse native plant communities at Wind Cave National Park, where measures to control the invasive plant species must consider potential harm to cave resources that lie beneath the landscape.

Manual control has many advantages. Equipment is minimal, consisting essentially of heavy-duty leather gloves. Weather is seldom a problem, although a breeze makes the work more pleasant and rain-moistened soil releases roots better than dry soil. No training or licensing is needed to pull weeds, allowing volunteers and park staff alike to participate. The environmental advantages of manual control are also compelling. Weed pulling introduces no exotic biological control agents (insects or pathogens) into the ecosystem. And, as opposed to many biological and chemical control methods, manual control is specific to the targeted species. It does not affect native plant species, except to free them from competition with exotic weeds, preserving native species diversity.

In the absence of Canada thistle, future visitors to Wind Cave National Park will discover diverse plant communities of native grasses, sedges, rushes, wildflowers, shrubs, and trees. ■

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The Middle Niobrara Weed Awareness Group: A collaborative approach to exotic plant management

By Carmen Thomson

THE NIOBRARA NATIONAL SCENIC RIVER (Nebraska) is an unusual park unit in that it does not own any land in fee title but is responsible for management of approximately 23,000 acres (9,315 ha). Exotic plant management has been a long-standing concern. Purple loosestrife (*Lythrum salicaria*), which overruns wetlands, is the main invading species, but leafy spurge (*Euphorbia esula*) and Canada thistle (*Cirsium arvense*) are also becoming problems. The park, however, has limited financial resources and personnel to implement an exotic plant management program. The unit does receive some assistance from the Northern Great Plains Exotic Plant Management Team, but in order to implement a successful exotic plant management program on a predominantly private landscape, the National Park Service works with partners.

In the past, park resource staff and other natural resource agencies conducted exotic plant management activities within the unit's boundaries, but there was a lack of standardization or coordination in these efforts. To remedy this problem, in 2002 the various agencies formed the Middle Niobrara Weed Awareness Group (MNWAG) to coordinate efforts, share expertise, and develop realistic project goals agreeable to all agencies involved. The group comprises 13 partners from state, federal, and private organizations, including the U.S. Fish and Wildlife Service, National Park Service, U.S. Geological Survey, Niobrara Council, The Nature Conservancy, Nebraska Department of Agriculture, North Central Nebraska Resource Conservation and Development, Nebraska Board of Education Lands and Funds, Rock County Weed Control, Cherry County Weed Control, Keya Paha County Weed Control, Brown County Weed Control, and private landowners.

The Niobrara National Scenic River … does not own any land in fee title but is responsible for management of approximately 23,000 acres [of predominantly private land].

Since its inception, MNWAG has made significant strides in exotic plant management. A major accomplishment in 2004 was defining a cooperative weed management area. This area encompasses the entire 76-mile-long (122-km) scenic river, and extends 1 mile (1.6 km) north and south of its banks. Plans include increasing the weed management area to the far western and eastern boundaries of both Cherry and Rock Counties in 2005.

An invasive species that overruns wetlands, purple loosestrife is a major concern of managers at Niobrara National Scenic River in Nebraska. By forming a partnership group to coordinate weed control efforts and planning and to share expertise, the National Park Service has recently completed a weed management plan for the park.

For this area, a Site Weed Management Plan has been completed. This plan includes GIS maps of specific management zones, landownership layers, and management treatments for each zone (e.g., biological control release sites, chemical application sites). A database has been created to record species present at each site, treatment type, size of treatment area, and digital photographs.

A major accomplishment in 2004 was defining a cooperative weed management area … [that] encompasses the entire 76-mile-long … scenic river, and extends 1 mile … north and south of its banks.

The efforts of MNWAG are receiving official recognition. It has been designated the seventh national pilot project for the USGS Early Detection and Rapid Response System for Invasive Plants. Furthermore, it was awarded a Pulling Together Initiative grant for $57,750 by the National Fish and Wildlife Foundation. With this grant the group was able to implement a cooperative cost-share program with private landowners within the scenic river corridor to control invasive plants through the application of chemical or biological control agents. Additionally, the group hired a contractor in August to produce aerial maps of infested areas that were difficult to reach by foot or all-terrain vehicle. These mapped areas will be treated in 2005.

Finally, a public meeting was held in December to update landowners and other NPS partners on MNWAG's achievements for 2004. This was a highly successful event because the National Park Service and MNWAG heard both positive feedback and suggestions for continued improvement of the program.

Without the willingness of private landowners and the various resource agencies involved, adequate exotic plant management at Niobrara National Scenic River might not be possible. The commitment and resources of these partners continue to make the scenic river a beautiful place that will be preserved forever for the enjoyment of future generations. ■

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Clonal tunicate invades Tomales Bay, California

By Ben Becker

A group of international experts in tunicate biology and taxonomy recently discovered the invasion of a clonal tunicate (*Didemnum lahillei*) in Tomales Bay, California. During a rapid biodiversity inventory in 2003, the scientists noted the presence of this soft, pink, spongy species—commonly called a "sea squirt"—and alerted staff at Point Reyes National Seashore. The tunicate has invaded many other estuaries, often overrunning both disturbed areas and native species with its matlike growth. An indication of the potential problem facing Tomales Bay is the recent discovery of *D. lahillei* in the famous Grand Banks fishing grounds off Massachusetts, where the species now covers 6 square miles (16 km^2) of seafloor. Investigators at Point Reyes are currently mapping the distribution of the species in Tomales Bay and have begun a small-scale experimental removal program with a local high school. The students are carefully removing the species by hand from

several test sites on both a monthly and a bimonthly basis to determine the optimum frequency of removal required for the most efficient control.

This clonal tunicate is native to the estuaries of Europe, and like most invasive marine species, was likely transported as a "hitchhiker" growing on the hull or in the ballast water of a ship, or possibly in a shipment of juvenile oysters from another estuary. In Tomales Bay the tunicate overgrows and chokes out native barnacles, sponges, and bryozoans (a plant-like marine animal) and has the potential to severely limit the amount of inter- and subtidal rocky habitat available to these native encrusting organisms. Tomales Bay also has a thriving oyster industry that relies on metal and wooden racks to grow the oysters. *Didemnum lahillei* could overrun these racks as it has in other estuaries, leading to costly losses for local harvesters. Because the clonal nature of the species ensures that even microscopic remnants regrow after removal, large-scale removals in other estuaries around the world have been unsuccessful. Nevertheless, park staff at Point Reyes hopes that periodic removals will keep the species at a low enough level that it does not become a significant threat to the ecosystem. ■

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